I-75 Modernization Traffic Noise Analysis Segment 12A

Oakland County, Michigan

Project Description

The I-75 roadway improvement project is located in Oakland County, Michigan. The Feb 2015 Noise Report represents an update the FEIS study document completed in May 2005. The present analysis addresses updates to the Michigan Department of Transportation (MDOT) traffic noise policy guidelines and impact criteria that became effective in 2011. These policy changes are outlined in the July 2011 *MDOT Highway Noise Analysis and Abatement Handbook*. In addition to the policy updates, future predicted noise levels were determined using Federal Highway Administration (FHWA) TNM 2.5 model rather than the TNM version 2.1 used during the FEIS phase. A map of the overall project study area is illustrated in Figure 1 with Segment 12A shown in the upper left hand corner. Along I-75, Segment 12A is bounded by Adams Road on its easternmost point to Squirrel Road on its most western extent.

FUNDAMENTAL CONCEPTS OF ROADWAY NOISE

Sounds occur in the human and natural environment at all times. Some sounds are necessary or desirable for communication or pleasure, some are unnoticed and other sounds are unwanted, causing annoyance and disturbance to the people living or working in the area. Therefore, by definition, unwanted sound is referred to as noise. The following sections provide a background for some of the physical properties and terminology of sound and noise.

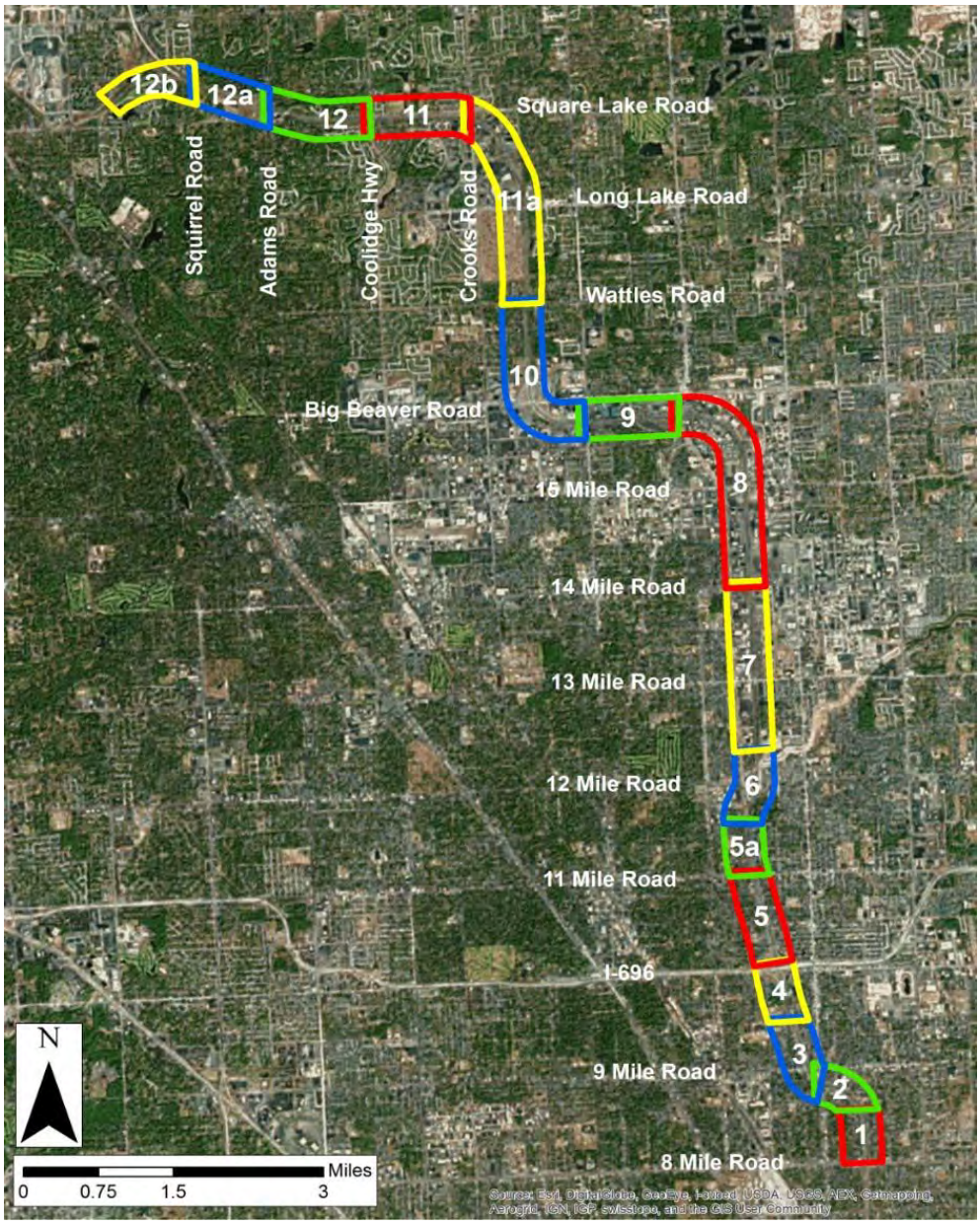
A-Weighted Sound Level

The most commonly used measure of noise level is the A-weighted sound level (dBA). From many experiments with human listeners, scientists have found that unlike animals the human ear is more sensitive to midrange frequencies than it is to either low or very high frequencies. At the same sound level, midrange frequencies are therefore heard as louder than low or very high frequencies. This characteristic of the human ear is taken into account by adjusting or weighting the spectrum of the measured sound level for the sensitivity of human hearing range. The A-weighted sound level is a measure of sound intensity with one-third octave frequency characteristics that correspond to human subjective response to noise weighted. The A-weighted sound level is widely accepted by acousticians as a good descriptor for assessing human exposure and annoyance from environmental noise. Figure 2 illustrates some common A-weighted noise levels.

An understanding of the following relationships is helpful in providing a subjective impression of changes in the A-weighted sound level:

- Except in carefully controlled laboratory experiments, an increase of only 1 dB in A-weighted level cannot be perceived.
- Outside of the laboratory, a 3 dB increase in A-weighted level is considered a just-noticeable difference.
- A change in A-weighted level of at least 5 dB is required before any significant change in the noise level in a community is perceived.
- A 10 dB increase in A-weighted level is subjectively heard as approximately a doubling in loudness, independent of the existing noise level.

Figure 1
TNM2.5 Segments



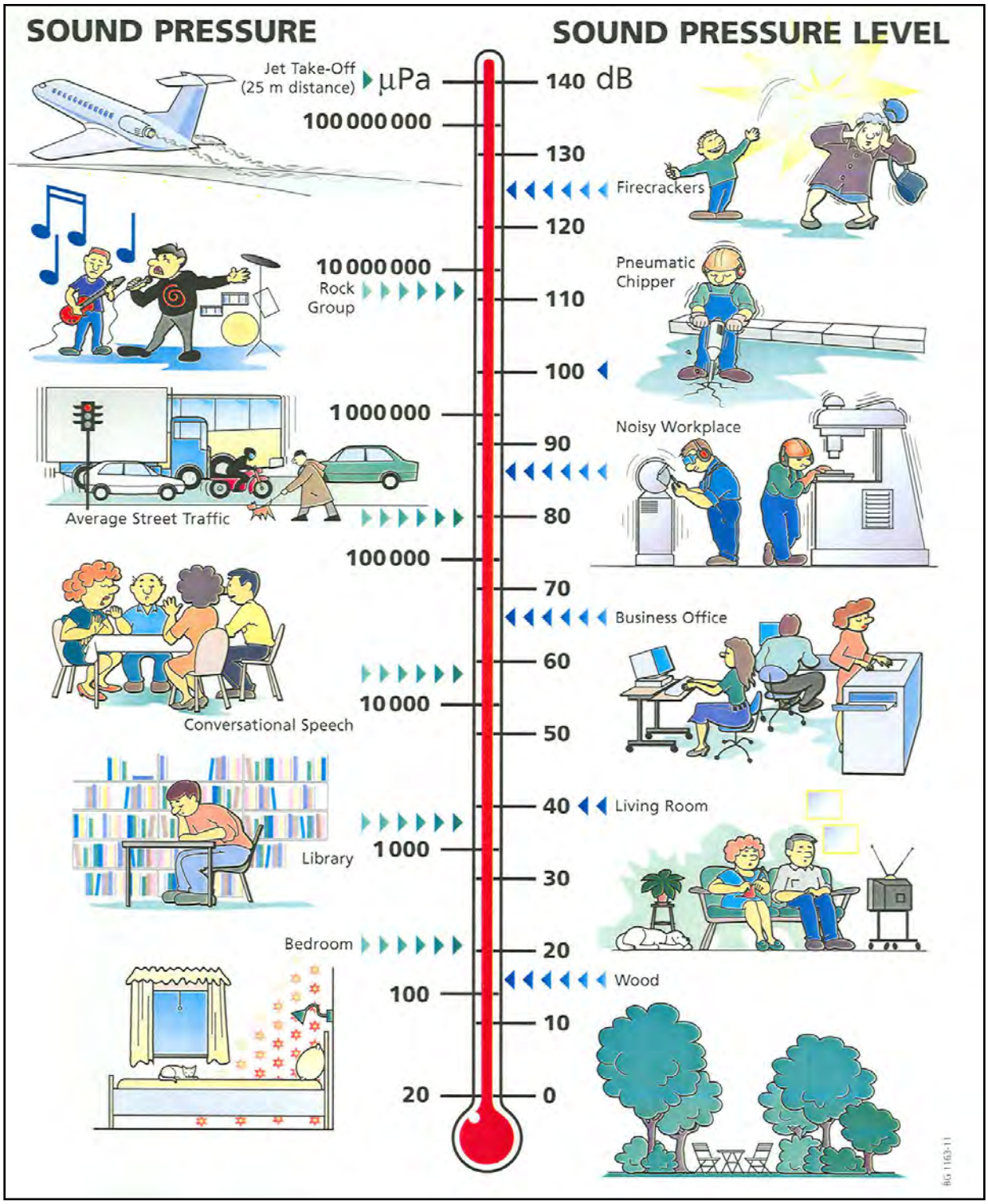
Sound Level Descriptors

The third basic parameter of environmental noise is its time-varying character. The sound level from any roadway fluctuates from moment to moment as time passes. These fluctuations constitute the time-varying properties of roadway noise.

Because environmental noise fluctuations vary from moment to moment, it is common practice to condense all of the information into a single number, called the "equivalent" sound level (L_{eq}). The L_{eq} is a measure of the average sound energy during a specified period of time (typically 1 hour duration). The L_{eq} is defined as the constant level that, over a given period of time, transmits the same amount of acoustical energy to the receiver as the actual time-varying sound. Studies have shown that L_{eq} noise descriptor is well correlated with human annoyance to sound; therefore, this

descriptor is widely used for environmental noise impact assessments. The L_{eq} measured over a one-hour period is the hourly L_{eq} (1-hour), which is used to analyze highway traffic noise impacts and abatement acoustic effectiveness.

Figure 1 Typical Noise Levels



Existing Ambient Noise Levels

Existing noise levels were determined at at two receptor sites located within the Adams Woods community. These locations are identified as measurement sites R27 and R27a in the I-75 Modernization Traffic Noise Analysis Report. A summary of Measured noise levels is presented in Table 1. Measured noise levels were found to be below the MDOT 66 dBA impact threshold.

Table 1

Summary of Amient Measured Noise Levels in Study Segment 12A

Receptor	Location	Date	Land Use Type	Time of Reading	Measured Leq (1hr) dBA
R27	Timberview east of Meadowglen Court	5-28-14	Residential Condo	6:30 PM to 6:45 PM	65.0
R27A	Timberview Rd	5-28-14	Residential Condo	6:53 PM to 7:08 PM	64.9

Future 2035 Build Conditions Noise Level Estimates

Figure 3 depicts the modeled receiver locations within the Adams Woods community. There is an existing private wall, parallel to the freeway that was built by the that community. The noise modeling of Segment 12A includes the Adams Woods Wall as part of the existing terrain. The TNM noise modeling of the Adams Woods community found only six impacted receivers as shown by the red dots depicted in Figure 3. A summary table of future 2035 Build noise levels at each modeled receiver in the Adams Woods community is provided in Table 3. TNM predicted noise levels at or above the MDOT 66 dBA impact threshold are shown in bold text. A replacement noise wall was not modeled because there are insufficient number of impacted properties necessary to reduce the cost per benefitted property below the MDOT cost effectiveness criteria. MDOT's cost effectiveness criteria has chosen a maximum reasonable cost of $44,187 per benefited receptor.

Conclusion

There is an existing private wall, parallel to the freeway that was built by the Adams Woods community. For the majority of first row properties facing I-75 this existing sound barrier provides some traffic noise reduction benefit. Existing ambient noise levels with the community were found to be below the MDOT 66 dBA impact criteria. As illustrated by the red dots in Figure 3, under future 2035 Build traffic conditions, noise levels at or above the MDOT 66 dBA impact threshold were found to occur at only six properties. A noise barrier analysis was not considered because there are insufficient number of impacted properties necessary to reduce the sound barrier unit cost per benefitted property below the MDOT cost effectiveness maximum allowable limit of $44,187 per benefited receptor. Furthermore, without the removal of the existing privately built sound barrier, any additional noise attenuation achieved by the construction of a second barrier, at the ROW line, will result in noise reduction levels below MDOT 5 dBA minimum feasible requirement. Therefore an additional sound barrier consideration for the Adams Woods community is not warranted.

Figure 3:
Segment 12a Recievers

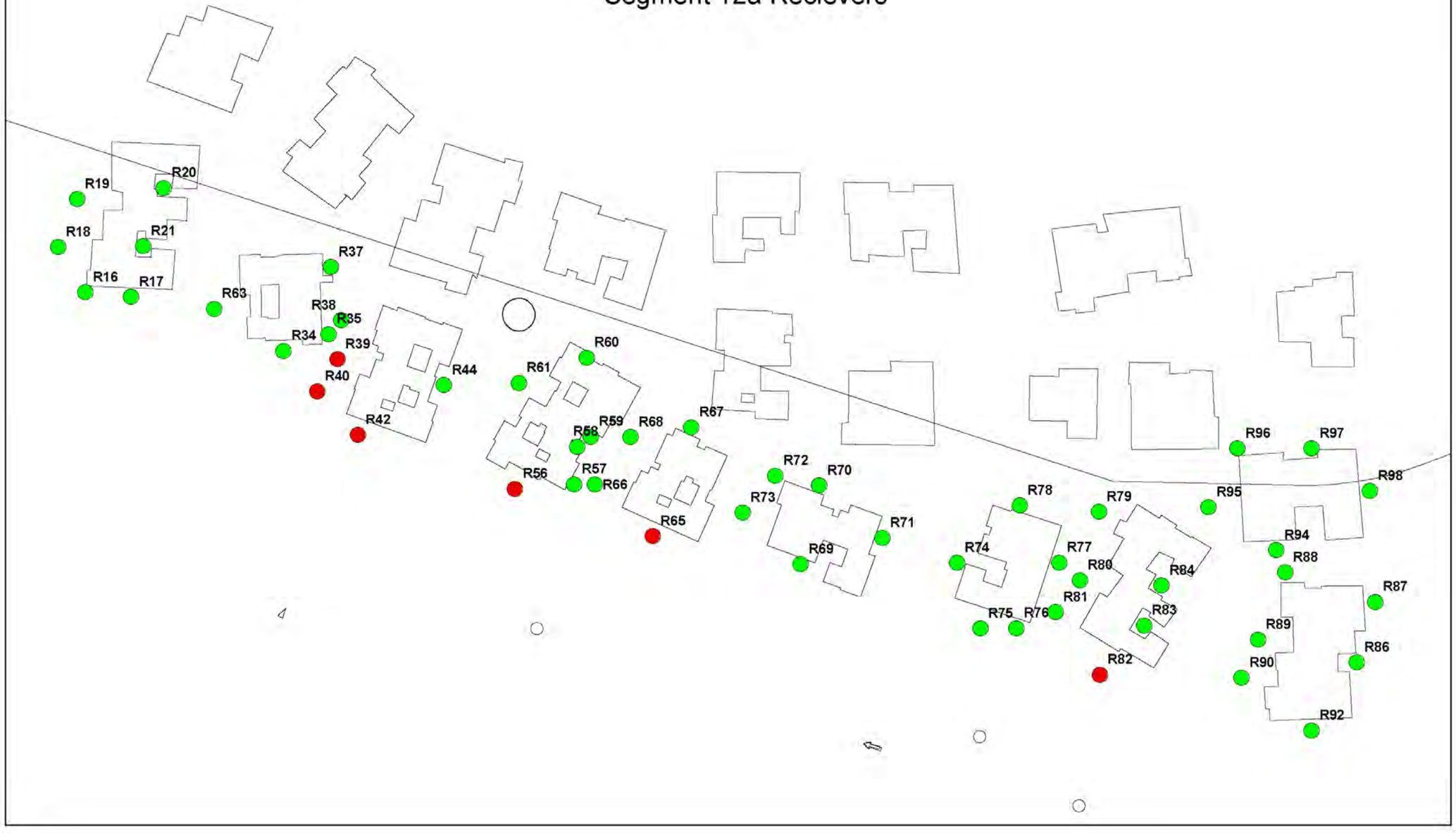


Table 3
Summary of Predicted Future Build Noise Levels

Receptor ID	Predicted 2035 Build Noise Level Leq (1 hr) dBA	MDOT/FHWA Impact (YES/NO)
Receiver16	62.7	No
Receiver17	62.5	No
Receiver18	61.7	No
Receiver19	64.7	No
Receiver20	50.7	No
Receiver21	51.3	No
Receiver22	60.7	No
Receiver23	64.4	No
Receiver24	63.3	No
Receiver25	56.4	No
Receiver26	52.3	No
Receiver27	54.2	No
Receiver28	53.6	No
Receiver29	51.9	No
Receiver30	50.3	No
Receiver31	49.7	No
Receiver32	48.3	No
Receiver33	54.1	No
Receiver34	62	No
Receiver35	52.6	No
Receiver37	49.8	No
Receiver38	65.4	No
Receiver39	**66.4**	**Yes**
Receiver40	**67.6**	**Yes**
Receiver42	**67.5**	**Yes**
Receiver44	57.6	No
Receiver45	62	No
Receiver46	62.7	No
Receiver47	61.7	No
Receiver48	61.1	No
Receiver49	55	No
Receiver50	55.3	No
Receiver51	51.2	No
Receiver52	56.3	No
Receiver53	56	No
Receiver54	51.2	No

Table 3 (Continued)
Summary of Predicted Future Build Noise Levels

Receptor ID	Predicted 2035 Build Noise Level Leq (1 hr) dBA	MDOT/FHWA Impact (YES/NO)
Receiver55	50.1	No
Receiver56	**67.1**	**Yes**
Receiver57	61.8	No
Receiver58	58.3	No
Receiver59	57.3	No
Receiver60	54.4	No
Receiver61	56.2	No
Receiver63	62.9	No
Receiver65	**69.8**	**Yes**
Receiver66	61.2	No
Receiver67	54.2	No
Receiver68	56.3	No
Receiver69	58.6	No
Receiver70	53.6	No
Receiver71	60.5	No
Receiver72	53.6	No
Receiver73	59.5	No
Receiver74	52.6	No
Receiver75	65.3	No
Receiver76	61.6	No
Receiver77	58.4	No
Receiver78	55	No
Receiver79	55	No
Receiver80	56.6	No
Receiver81	60.4	No
Receiver82	**65.7**	**Yes**
Receiver83	62.4	No
Receiver84	57.6	No
Receiver86	60.2	No
Receiver87	61	No
Receiver88	55.3	No
Receiver89	60.4	No
Receiver90	63.2	No
Receiver92	64	No
Receiver94	59.5	No
Receiver95	57.8	No
Receiver96	54.1	No
Receiver97	53.1	No
Receiver98	61.3	No